

Study of Development Trends and Application Risks of Cryptocurrency and Blockchain Technologies in the Digital Environment

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The paper is devoted to the study of the formation and development trends of cryptocurrency and blockchain technologies in the digital economic environment, as well as the risks and dangers of their application. According to the features of classification, the main features of virtual currencies have been explained. The risks and dangers that may arise with the regular use of cryptocurrency and blockchain technologies emerging in the digital environment were considered. As a result of the transformation of digital technologies, the study of the problems of formation and development of cryptocurrencies and blockchain technologies is one the urgent issue. As a result of improving the management of economic and business processes on the basis of modern ICT, a digital economic environment with new non-traditional technological features is being formed. The possibilities of applying cryptocurrency and blockchain technologies in economic structures and processes in the new economic environment have been explored. The security features of blockchain technology and the mechanism of operation of the cryptocurrency have been explained. The differences between cryptocurrency and traditional money have been explained, and the essence of different approaches to cryptocurrencies in the international arena has been analyzed. Statistical analysis of scientific publications on cryptocurrencies has been conducted. The capitalization dynamics of cryptocurrency are presented. The rating of cryptocurrencies is shown according to the level of capitalization. The dynamics of price changes in Bitcoin are given. The structural content of cryptocurrencies and blockchain technologies was explained, and their application in economic operations was studied. The risks and dangers of cryptocurrency in the digital environment were analyzed. The mechanism of their operation in business and financial operations was explained. The dangers of the use of cryptocurrencies in the existing traditional financial system have been identified. The problems of legal regulation of cryptocurrencies in the world have been analyzed. It was noted that although the use of such technologies poses risks and threats in modern financial markets and cryptocurrency exchanges, they can create new opportunities and prospects for the future development of the country's economy in the digital environment. In the 4.0 Industrial Platform in the Digital Environment, some recommendations have been given for preventing the risks and dangers of using cryptocurrency and blockchain technologies.

Keywords: Digital transformation, Digital economy, Digitalization, Digital economic environment, Digital currency, Bitcoin, Cryptocurrency, Blockchain technology, Risks and dangers of use, Cryptocurrency exchanges

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1 Introduction

In recent decades, modern ICT has created a digital economic environment with new features, influencing economic and business process management processes. In the new environment, which has both global and national, and regional characteristics, the impact of e-business, and e-commerce on the

development of the economy already covers all areas of society. With the creation of digital trading portals in many areas, regional Digital Trade Hubs [1] are emerging and they are strengthening the economic, business, and financial position of the region. Other relevant measures are being taken to expand foreign trade operations in this area.

The emergence of cryptocurrency technologies in the digital economy has created certain difficulties in the traditional business and financial sector. At the same time, the digital economy, which is in close symbiosis with the elements of the existing financial infrastructure, has created positive trends for a more effective form of the financial sector. The emergence of cryptocurrency technologies and virtual currency has encouraged financial institutions, development institutions, and the state to participate in the development of new projects.

The development trends and application risks of cryptocurrency and blockchain technologies in the digital environment have been studied to some extent by some researchers [2-10].

Being one of the first countries in the Asia-Pacific in terms of cross-border trade has made a positive contribution to further improving its position in the field of foreign trade in the global arena. It should be noted that according to the United Nations Global Report on Digital and Sustainable Trade 2021 [11], Azerbaijan leads the region in Southern and Eastern Europe, the Caucasus, and Central Asia with a score of 86% according to certain criteria. Compared to 2019, in 2021 the transparency indicator increased by 7% and achieved maximum results. Azerbaijan has made significant progress on the report's cross-border paperless trade indicator, an increase of 33%. The report compares the current situation in the country with previous years and provides detailed information on the reforms that led to these improvements.

One of the key issues is the increasing focus on information, digital, e-economy, cryptocurrency, blockchain concepts, and technologies as a result of the widespread use of digital technologies in recent decades. Currently, the opportunities for the application of cryptocurrencies and blockchain technologies in the management processes of advanced countries are increasing. Therefore, the issue of coordinated action for the use of cryptocurrency and blockchain technology is one of the most

pressing issues of our time. For this reason, it is important to study the trends in the formation and development of cryptocurrencies and blockchain technologies and to consider the potential gaps, threats, and risks. Currently, the development and use of various cryptocurrencies are becoming more dynamic, and in recent years, these trends have significantly affected the development of the digital economy.

The object of research is the characteristics of the application and use of cryptocurrencies in the new digital environment, which is formed as a result of the digital transformation of regional and national economies.

The subject of research is the study of trends in the formation and development of cryptocurrencies and blockchain technologies with new commodity and currency qualities in the emerging digital environment, as well as the dangers, risks, and other undesirable situations created by their use.

The methodology and methodological bases of the research were systematic approach and analysis methods, statistical analysis methods, correlation, and component analysis, synthesis, and generalizations. In the research process, scientific works of many researchers, priorities, laws, other normative-legal acts, and methodological materials of relevant research institutes, and centers were used in studying and generalizing the features of theoretical-methodological approaches in the existing field. It is recommended to consider the results of the study in perspective changes in the economic life of the country, reforms, decision-making processes, economic and business operations, and the development of new regulations.

2 Problem statement and research situation

There is a serious need to study the characteristics of the use of cryptocurrencies and blockchain technologies in the information and digital economy, the formation and development trends, as well as the dangers and risks that arise during their use. The aim of the study was to study these problems. To achieve this goal, a comprehensive study of the features,

advantages, distinctive features and development trends of cryptocurrencies in the digital economic environment has been set.

In connection with the study of the problem, it should be noted that over the past decade, research and discussions on blockchain technology and cryptocurrencies around the world have attracted serious interest from international financial institutions, the scientific community, and public and private institutions [12]. These processes are affected by various factors such as global instability of economic relations, the dominance of certain reserve currencies over national currencies, global digitalization of the economy and the violation of borders, the crisis of confidence in existing financial and payment systems, and so on. In such a situation, it is difficult to study the characteristics of cryptocurrencies and trends in the formation and development of blockchain technologies and their application. Research in this area is mainly aimed at identifying prospects for the introduction of cryptocurrencies, which are digital money and increasing their sustainability. In principle, the problems of the application of cryptocurrencies and the trends in the formation and development of blockchain technologies have been studied to some extent by a number of foreign and domestic researchers [2, 13-16]. In this research, the formation and use of digital currencies, as well as their normative legal regulation at the global and regional levels are involved in the research process. However, there are significant obstacles to solving the problems that arise in the use of cryptocurrencies. The study of trends in the formation and development of cryptocurrencies and blockchain technologies is of particular importance for the identification of relevant potential opportunities in this area.

3 Classification and main features of virtual currencies

International financial institutions believe that 1) cryptocurrency is a virtual currency, 2) a currency with a digital expression of value, 3) it can be traded in digital form, 4) a means of exchanging or storing value, 5) it has no status as a means of payment in any jurisdiction [17]. For these reasons, electronic payment systems, which are relevant in the form of virtual currency, cannot replace traditional banking systems. The main disadvantage of virtual currency internationally is its lack of legal status. Nevertheless, virtual currency is actively bought and sold, stored as fiat on electronic cryptocurrency exchanges, and invested in various projects, including the material sphere. Virtual currency can be converted into almost any world currency by converting it into traditional currencies on electronic exchanges.

Classification of virtual currencies depending on their status, circulation conditions, source of issue, purpose of use is one of the problematic issues.

From this point of view, virtual currencies can be classified as shown in Figure 1, considering many key features and characteristics. However, it should be noted that this classification does not consider the legal aspects of owning a virtual currency.

In general, some of the main features of virtual currency can be considered as follows: Virtual currency is a completely decentralized, secure digital currency, the creation of which is controlled by cryptography. Virtual currency is not issued by central banks and its value does not depend on the policy of banks. Unlike ordinary currencies, the prices of virtual currencies are based only on supply and demand. Virtual currency is volatile, and the difference between the selling and buying prices of these instruments can vary significantly even in the short term [17].

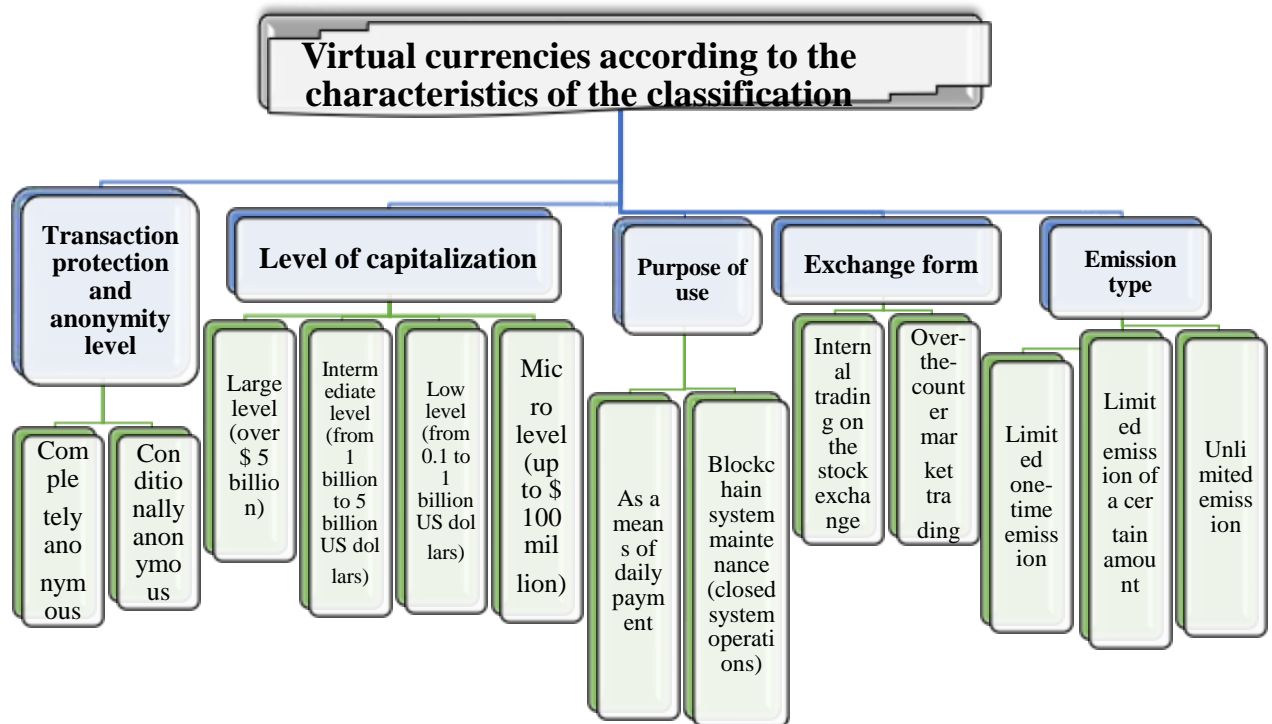


Fig. 1. Virtual currencies according to classification features (*compiled on the basis of analysis of scientific literature*)

Although the first virtual currency was Bitcoin (Bitcoin), created in 2009, today there are thousands of alternative virtual currencies called altcoins (Ethereum, ripple, litecoin, and others).

4 Essence-content features and classification of cryptocurrencies

The market has grown rapidly since the emergence of Bitcoin, the world's first cryptocurrency, in 2009. There are many tools on the market today, including one based on distributed booklet technology. The most common term for such tools is crypto active. A cryptocurrency is an asset that exists in digital form or is a digital representation of

another asset. It is an asset created using distributed booklet technology. Different cryptocurrencies have different functions. Some of them are used for payments, while others are not used. Some are essentially securities. It would be useful to make some notes on the classification of cryptocurrencies. The issuer of the central bank's digital currency is the state represented by the central bank. Issuer assets (Figure 2) include electronic money (eMoney), unsecured cryptocurrencies, stake coins, and tokenized assets. 1) Electronic money. It is a digital alternative to cash issued by a private issuer. 2) Unsecured cryptocurrencies.

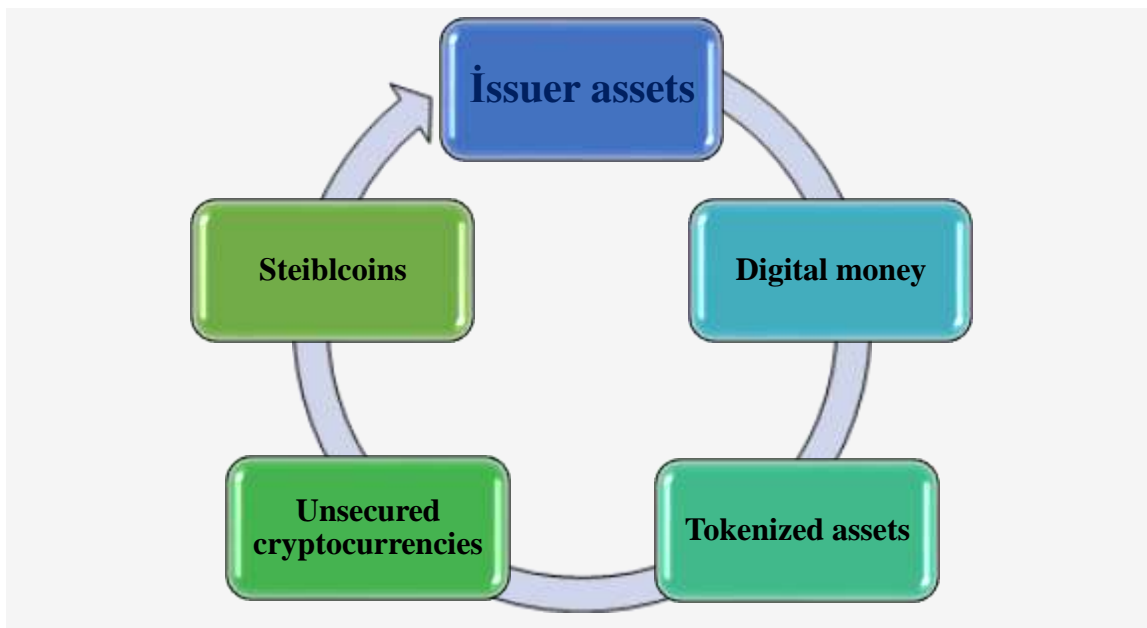


Fig. 2. Composition and structure of the issuing assets

It is crypto active, characterized by a lack of security. They are cryptocurrencies that cannot be withdrawn by the issuer. Intended for use as a means of payment only. The most common cryptocurrencies in the world are Bitcoin and altcoins. 3) Staiblcoins are backed by other assets, unlike altcoins and bitcoins. A special system is used to limit the volatility of the exchange rate when it is issued. They may be used for payment purposes or may represent an analogue of a money market fund or another property complex. In this case, the security mechanism may be opaque and incomplete without the necessary legal basis. 4) Tokenized assets. These are cryptocurrencies that can be used to secure certain rights for their owners. They can be divided into the following types: analogues of debt securities, analogues of shares confirming the participation in the capital of organizations, confirmation of the right to purchase a particular product or service, etc.

5 The working mechanism of cryptocurrency

As noted, cryptocurrencies are digital currencies designed to keep exchanges secure and, in most cases, anonymous. They are based on cryptography, i.e. encryption. Along with Bitcoin, the first digital currency, Ripple Ethereum, Blackcoin Litecoin, etc. such as

digital currencies are available. Ripple is the name of both cryptocurrency and distributed booklet technology (DLT) in which it is exchanged. The main feature of this system is that it allows users to make transfers in both electronic and real currencies. In 2018, the number of cryptocurrencies exceeded 1,300. Cryptocurrencies have nothing to do with the central bank or official bodies. Thus, digital currencies allow users to make secure payments and investments without going to the bank.

As a result of the application of algorithms for solving complex mathematical problems, computer computing power, and other capabilities are used to generate money in a virtual environment. Such activity is called mining, and those engaged in this activity are called miners. Users can get their money from brokers (intermediaries) and then use it to spend or collect their money in a secure way through encrypted transactions.

6 The difference between cryptocurrency and traditional money

Unlike traditional payment units, digital money transactions do not carry any personal information. Accounts are always accessible. Traditional accounts can be restricted and frozen by the system. Such cases do not occur due to the lack of legislation regulating the

digital currency. There are no cases of forgery. Cryptocurrencies are digital and secure. Thus, unlike traditional money, counterfeiting in digital currency is practically impossible. There are no or few additional fees. Banks charge for transactions. Because digital currencies are exchanged over the Internet and without the intervention of third parties, there is usually little or no transaction fee required. There are different approaches to cryptocurrencies in the international arena. The rapid rise of cryptocurrencies compared to traditional currencies has forced various countries and official bodies to take appropriate steps in this direction. Some countries, such as Russia, are preparing to create their own cryptocurrencies. UAE, Kuwait, Bahrain, Saudi Arabia, Indonesia, Malaysia, and others. Some countries, such as the United States, have already achieved this. Also, in many countries, such as Japan, the United States, and Ukraine, cryptocurrencies are already recognized as legal assets in official settlements and exchange activities. However, the world's approaches to cryptocurrencies are ambiguous. Thus, along with the rapid development of cryptocurrencies and their rapid rise compared to traditional currencies, there are also dangerous aspects such as tax evasion, financial flows out of the country, etc. For this reason, despite the growing interest, a number of countries are opposed to the digitalization of currencies. These countries are trying to prevent the spread of cryptocurrency in various ways. Thus, some countries warn the population through propaganda, ie warning about the dangers of investing in cryptocurrencies. In other countries,

cryptocurrencies are not recognized as a currency and are not accepted as a means of payment. In international practice, there are cases when cryptocurrencies are inspected or completely banned in order to avoid tax evasion and use in criminal financing.

One of the differences between cryptocurrency and traditional money is that it is impossible to pay salaries directly in cryptocurrency [18]. Rather, it means that it is illegal to pay salaries directly in cryptocurrency. There are two options for doing this: 1) Similar to the stock options paid to the top management of large companies, employees are offered options to acquire a stake in the company after a certain period of time.

Tokens only confirm ownership. 2) After converting cryptocurrency into money, a part of the employee's salary can be paid as a bonus. In other words, restrictions can be removed by additional operations, and in the end, the salary is obtained directly in cryptocurrency with the corresponding money.

7 Statistical analysis of scientific publications on cryptocurrencies

Due to the different nature of the use and application of cryptocurrencies, research articles related to them can also be grouped and analyzed by field [14]. Quantitative analysis of articles indexed in high-ranking scientific databases shows that 156 articles in the field of economics, 125 in the business finance sector, 96 in computer science and information systems, 62 in law, and 14 in management were indexed in WoS during the study period (Figure 3).

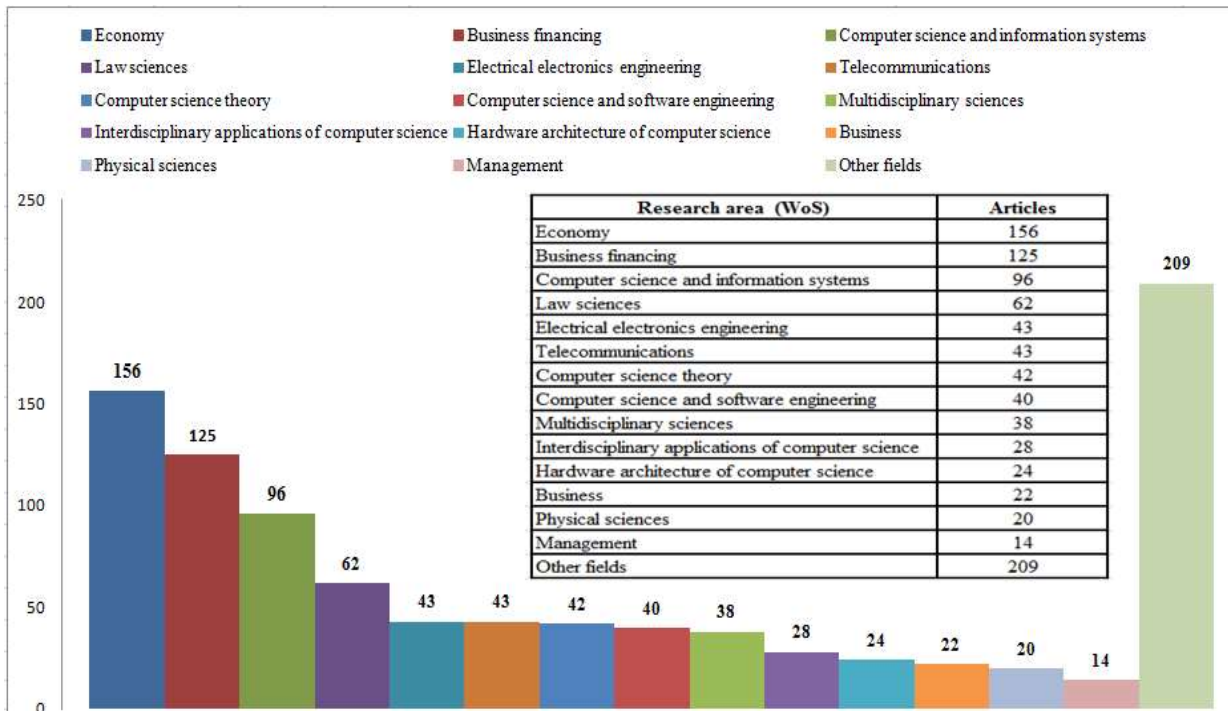


Fig. 3. Distribution of scientific articles on cryptocurrencies in WoS by areas of research (based on an analysis of the scientific literature)

During this period, 269 scientific articles on computer sciences, 217 in economics, econometrics, and finance, 188 in social sciences, 166 in engineering, 70 in

mathematics, and 16 in agricultural sciences, and biological sciences were published in the Scopus database on cryptocurrencies (Figure 4).

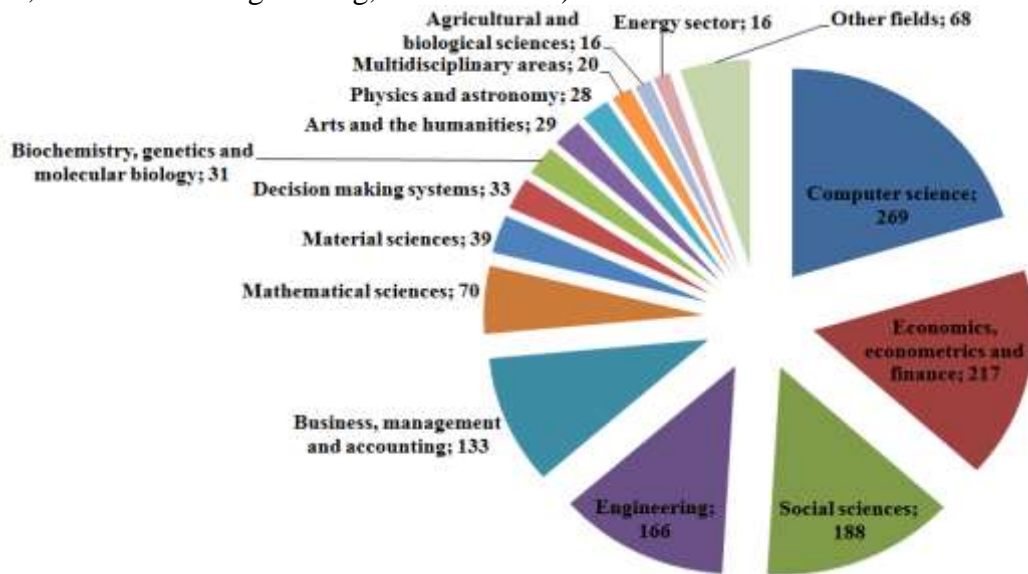


Fig. 4. Distribution of scientific articles on cryptocurrencies in Scopus by areas of research (compiled based on an analysis of the scientific literature)

Cryptocurrency exchanges or digital currency exchanges operate as a place that allows customers to trade cryptocurrency. A cryptocurrency exchange is an organization or

digital trading platform that buys and sells crypto and digital assets. Cryptocurrency trading is an act of buying and selling cryptocurrencies for profit. Cryptocurrency

exchanges can be market makers. They usually use the spread of offers as a commission for services or simply as a suitable platform for charging fees. Classic cryptocurrency exchanges include the Chicago Mercantile Exchange (CME), the Chicago Board Options Exchange (CBOE), and the BAKT (New York Stock Exchange) regulated cryptocurrency exchanges. Their regulators and supported currencies are usually collected from official websites or blogs [2].

8 Capitalization dynamics of cryptocurrency

Despite the fact that there are thousands of cryptocurrencies on the stock exchanges, their

number is growing every year [12]. The total capitalization of cryptocurrencies amounted to \$ 243 billion.

According to the conditions specified in the most common and popular Bitcoin algorithm, the maximum amount of its production is 21,000,000. More than 18 million bitcoins have already been extracted.

It is estimated that the total issue of bitcoin will end in 2140. Bitcoin is also the most expensive cryptocurrency. In 2020, it was over \$ 8,000.

The value of Bitcoin is subject to sharp fluctuations. In 2017, the price of one bitcoin was able to rise from about \$ 1,000 to \$ 20,000 (Figure 5).

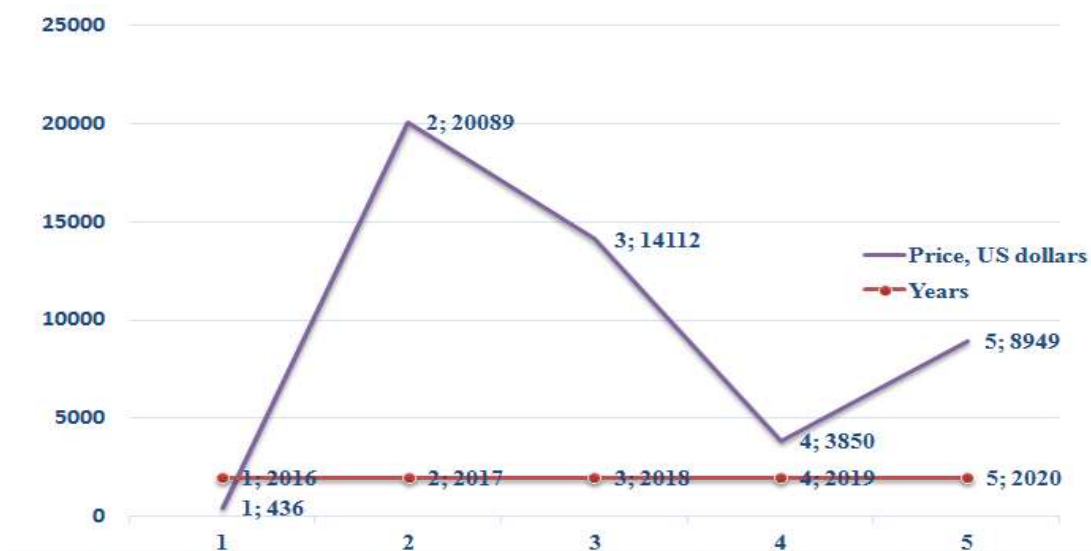


Fig. 5. Dynamics of Bitcoin price changes, bln. US dollars (for 2016-2020)

(Source: <https://coinmarketcap.com/ru/currencies/bitcoin/historical-data/>-

Compiled according to the source)

There are other cryptocurrencies that are equally popular in the cryptocurrency market today. They are also required by many users. The first seven popular cryptocurrencies are shown in Table 1 [12]. As can be seen from Table 1, Bitcoin has the largest capitalization level of \$ 163 billion, accounting for virtually 70% of the total cryptocurrency capitalization of \$ 243 billion. After Bitcoin, the leading cryptocurrency is Ethereum. Unlike Bitcoin, Ethereum is not only a means of payment but

also an element of transaction registration and property exchange. This factor allows us to say that Ethereum has great growth potential. Ethereum currently has a market capitalization of 8.2% of total capitalization, second only to bitcoin. The top three are closed by a reliable and cost-effective cryptocurrency called XRP or Ripple. Its capitalization is more than \$ 8 billion. Unlike all other cryptocurrencies, it has an issue of 100 billion units.

Table 1. Rating of cryptocurrencies by capitalization level (2020)
 (Source: <https://coinmarketcap.com/ru/currencies/bitcoin/historical-data/>)

No	Name	Market capitalization, billion US dollars	Price per unit, USD dollars	Volume of turnover in 24 hours, billions of US dollars	Maximum emission
1	Bitcoin (BTC)	163, 0550	8 873,17	41,6304	21 000 000
2	Ethereum (ETH)	20, 9968	189,32	14, 9138	—
3	XRP	8, 6728	0,19660 7	1, 9565	100 000 000 000
4	Tether	6, 3765	1,00	47,6374	-
5	Bitcoin Cash	4, 2538	231,11	3,4276	21 000 000
6	Bitcoin SV	3, 4193	185,79	1,9159	21 000 000
7	Litecoin	2, 7305	42,19	4,6495	84 000 000

For a more detailed analysis and assessment of the dynamics of cryptocurrency capitalization, the dynamics of cryptocurrency market capitalization can be given as shown in Figure 6 [12].

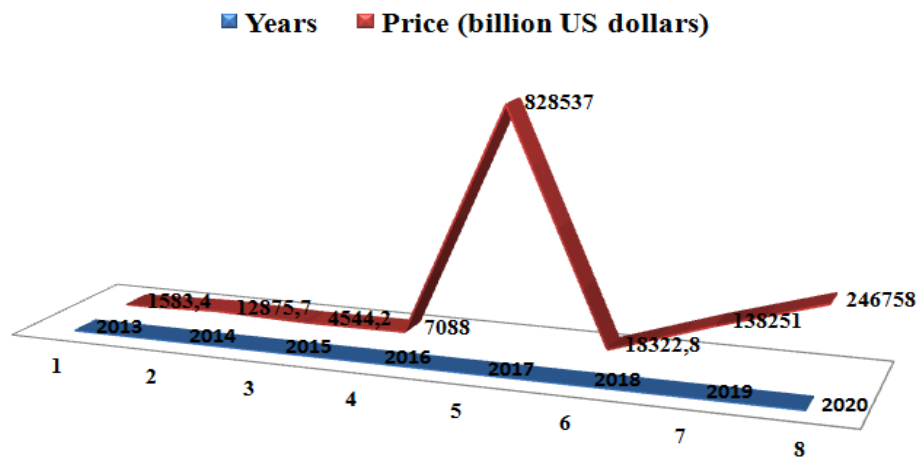


Fig. 6. Capitalization dynamics of cryptocurrency

Source: <https://coinmarketcap.com/ru/currencies/bitcoin/historical-data/>
 Compiled according to the source)

9 Cryptocurrencies and blockchain technology

Recently, blockchain technology has also become a global phenomenon. Blockchain technologies and digital currencies, which are met with interest by countries, international organizations, and giant companies, are widely studied. New mechanisms are being formed for the application of these technologies.

Distributed ledger technology (DLT) is known with Blockchain. Although blockchain was created in the beginning, with the

formation of alternatives, DLT began to be used to generalize them. DLT technology allows any database to be stored in multiple sources, almost all users, rather than in a single source. In this case, any operation is performed by all users, and after execution, the information is updated in each directory. Even if any user changes the information, the system checks this indicator with the indicators of other users and does not allow the operation.

Blockchain technology is one of the applications of DLT. Literally means block

chain. Blockchain technology is a booklet that records various types of transactions automatically and online. The history of this technology dates back to 2008, when the first cryptocurrency, Bitcoin, was created.

Features of blockchain technology.

Blockchain is a technology that does not have a centralized control system. Copies of the recorded data are stored on the computers of miners around the world and form a block chain. When a new operation is performed, the previous data is not deleted and added to the existing block chain. Because the data is copied and stored in the memory of all computers, it is not possible to delete them at the user level. The information collected here is accessible to users. However, other outsiders do not have access to the information. Therefore, the safety of the technology is guaranteed.

One of the advantages of the new technology is that there is no need for intermediaries in the implementation of operations. Thus, the two parties wishing to conduct an operation between them can carry out the operations they want without the intervention of a third party or organization.

10 Risks and threats of cryptocurrency in the digital environment

The widespread use of cryptocurrencies is increasingly threatening the existing traditional financial system. This confirmed the views of international financial institutions on the creation of conditions for the gradual expansion of the crypto-economy. The globalized payment mechanism will allow for more efficient cross-border transfers and the development of the information economy. It should be noted that there is still no unified approach and methodology in the world for the recognition of virtual currency as a means of payment and the regulation of its circulation.

The future development of cryptocurrency in the world requires a deeper understanding of the nature and risks of its use, as well as the definition of its role in the modern economic system. For this reason, the main goal of many researchers is to study in detail the nature and

principle of operation of cryptocurrency in the information economy, as well as the opportunities and prospects of its use in the national economic and financial system, to develop relevant recommendations [12]. As a result, the identification of innovative features of cryptocurrencies and prospects for their application has become a necessary and urgent issue.

There is a need for research on the development of foreign legislation in the field of combating criminal activity using cryptocurrency [19]. For the normal functioning of law enforcement agencies around the world, it is necessary to consider the problems of the legal regulation of cryptocurrencies.

The number of crimes related to the widespread use of cryptocurrency has increased. Hackers stole \$ 1.7 billion worth of cryptocurrency in 2018. Of this, 960 million were obtained from cryptocurrency exchanges and payment systems. The number of such cases has increased 3-4 times compared to previous years. 56% of cryptocurrency thefts took place on the exchanges of South Korea and Japan. The biggest thefts of 2018 were: \$ 532 million from Coincheck; \$ 60 million from the Zaif; \$ 40 million from Coinrail; \$ 31 million from Bithumb [19].

At the 13th meeting of the G20 (Buenos Aires, Argentina) in 2018, the Declaration "Creating a consensus for fair and sustainable development" was adopted. It was noted that the regulation of cryptocurrency markets in the context of an open financial system is important for sustainable development. In 2020, the Fifth EU Directive entered into force. New rules and tightened the requirements for cryptocurrency platforms have been developed by this directive. Cryptocurrency exchanges, cryptocurrency wallet providers, and data providers were required to register with a local regulator, submit suspicious activity reports and conduct customer due diligence [19].

The issues of protection of electronic information in the information system from its illegal users are related to changes in the interaction between people and organizations.

The fight against terrorism and money laundering is now significantly more difficult. It is very important for organizations that can secretly prepare nuclear, radiation, chemical, and biological terrorist acts to be able to get money from non-transparent sources without the attention of governments.

Digital currencies are also used by such groups and networks. They use modern information technology to conduct complex financial transactions in the digital space using cryptocurrency. The creation of bitcoins as a virtual analog of cash has implemented the idea of direct payments among Internet users, which virtually eliminates the possibility of tracking the transfer of funds from one person to another. The anonymity of the Bitcoin system makes it possible to almost eliminate the dependence of the shadow economy in the world on legitimate economic structures.

A number of cryptocurrencies (Dash, Monero, Zcash, etc.) provide good anonymity. In order to increase efficiency and conceal their criminal activities, terrorist organizations try to manage their socio-political and economic systems on the basis of a distributed registry. Criminal organizations used sophisticated cyber tools to attract cryptocurrency donations from all over the world. The results of the operation have shown that the activities of various terrorist groups have been adapted to the modern conditions of the cyber era. Each group uses cryptocurrency and social networks to raise funds in the interests of terrorist organizations. U.S. authorities have seized millions of dollars, and more than 300 cryptocurrency accounts, and blocked several criminal websites and Facebook pages under a court order. Experts also use sites linked to terrorist organizations to detect and identify gray schemes that collect donations in bitcoins.

A report published in 2019 by the Center for International Security and Defense Policy of the American corporation RAND noted the technical and organizational difficulties of terrorists in the use of cryptocurrencies and identified potential threats. According to the center, terrorists sometimes refuse to use

cryptocurrencies for fear of hacking and anonymity. Experts believe that digital assets are not as dangerous as a means of financing international terrorism. Rand Corporation's research shows that none of the known cryptocurrencies can meet all the financial needs of terrorist organizations, such as anonymity, usability, security and reliability. Bitcoins can be attractive to use in fundraising. There is also evidence that terrorist organizations can use cryptocurrencies for this purpose. Some experts say the predictions of terrorists' use of cryptocurrencies are exaggerated. They believe that terrorists are not ready to use new technologies to organize criminal proceeds. Analyses show that as the use of cryptocurrencies expands and their operational infrastructure develops, virtual currency will become increasingly used to finance terrorism [4]

Terrorist organizations have sophisticated information technology. They also use cryptocurrencies in their activities. Terrorist activities can also be funded by individual states and organizations in their own interests. Terrorists are increasingly using electronic payment systems and cryptocurrencies. They use these opportunities to transfer funds from certain countries and organizations that support the global terrorist network. Observers note the widespread use of encrypted Internet communications, cryptocurrencies, remote control of terrorist activities and its financing schemes. The use of cryptocurrencies by terrorists can sometimes outweigh state and interstate reactions. Because the attitude of states to this tool is unstable. They are slowly adapting to new cyber threats in terms of national legislation, organizational and technical tools and methods.

11 Result and suggestions

The diversified and sustainable development of the regional economy, including cyber resilience, is conditioned by the current state of ICT infrastructure and modern information technologies, as well as the technical and technological sovereignty of the region [20].

Systematization and considering the formation and development trends of digital assets, digital currencies, cryptocurrencies and blockchain technologies created by the stable economic environment in such conditions allows to determine economic orientations and priorities.

Based on research and analysis, it can be assumed that in the medium term, financial and economic structures and trade organizations can gain potential economic opportunities, considering the results of the formation and development trends inherent in blockchain technology and cryptocurrencies. From this point of view, considering the pros and cons, innovative features of cryptocurrencies during their traditional use, it is possible to make progress in the management of economic processes and correct decision-making and to protect against certain threats and risks.

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